



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Cotton-leaf Analytical Test for the Mid-South U.S. To Prevent the Over-application of Nitrogen Fertilizer

Duration: From September 1, 1997 to August 31, 1998

Federal funds: \$39,600

Non Federal Funds: \$79,200

Names, universities, and cities of investigators:

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Congressional districts of universities performing the research:

Alabama 3rd, Arkansas 1st, Louisiana 6th, Mississippi 3rd, Mississippi 2nd

Statement of the critical regional water problems: *Project to address Southeastern/Island region priorities of water quality and non-point source pollution:* Nitrogen (N) fertilization is a required practice for the millions of hectares of cotton (*Gossypium hirsutum* L.) in the Mid-South USA. Cotton is a heavy feeder of N and the most important element in its nutrition. Overapplication of N is a small expense compared to land or insect control and it can be argued that overfertilization is a reasonable method of preventing potential N deficiencies. Nitrogen fertilization is an unregulated practice in almost all of the U.S. The overapplication of this element to crops

has produced pollution of groundwater and, it is suspected, to be the source of nitrate-nitrogen implicated in the cause of the dead zone in the Gulf of Mexico. Nitrate-N may leach to groundwaters when fertilizer applications exceed plant needs or if fertilizer application is not matched to when plant uptake occurs. Methods in use today to predict the N status of cotton are either inaccurate or were derived from surveys and no test of their accuracy has been done. The project proposed here will calibrate a promising, but unproven, analytical tool to assess the N status of cotton and prevent unneeded N applications and the leaching of N to groundwaters.

Fertilization experiments done by us have shown that Louisiana cotton requires a one time application of 70 to 110 kg/ha of N applied near planting for cotton on silt loam or similar soils. Many farmers apply more N than is needed and others supplement an initial adequate application of N with unneeded mid-season applications. Mid-season applications are recommended as a regular practice by some fertilizer dealers and are required in a few cases when N has been leached from the root zone or during a drought. Mid-season N applications are often unnecessary and may result in N leached from the root zone. Analytical tools are needed to determine if cotton is N deficient at mid-season and if N applications are needed. Soil tests have not proven reliable in predicting the amount of N available to cotton because of the humid-South conditions of low organic matter soils, high capacity for buffering ammonium-N in the soils, complexity of N transformations in the soil biosphere, and erratic weather conditions. Analyses of the cotton leaf, however, may be an effective tool for assessing cotton N status. The accuracy of a cotton-leaf diagnostic method has been tested only in a few preliminary studies.

Statement of results, benefits and information expected from project:

Over-fertilization of cotton and nitrate leaching to groundwaters from cotton fields will be lessened if farmers are given tools produced from this proposal. Now, farmers do not have an accurate quantitative measure of the N status of cotton at early or mid-season. Considerable mid-season applications of N fertilization occurs despite research indications that these applications do not *often* increase yields. This study provides evidence that will be evaluated by our peers, farmers, Extension personnel, and regulatory agencies and judged as to the test's efficacy in predicting the N status of cotton. Information from this project is essential in conferring credibility or rejection of our mid-season N test. Our first-year results indicate our leaf test a more stable indicator of the N status of cotton than petiole methods and that previous sampling methods thought to be more sensitive were less sensitive (Bell et al., 1997). Some of our results were confirmed by a small study in North Carolina (Hodges, 1997).

The tissue test from this project will be valuable for University Extension personnel regulatory agencies. Efficient use of N is not as high of a priority with some farmers as is insect control or marketing. N fertilizer costs for cotton are about \$74/hectare while the total cost for producing a hectare of Louisiana cotton is about \$1,200 with \$250 for insect control. Overapplication of N can be an insurance against a deficiency or a result of faulty recommendations from consultants who benefit more from errors occurring from

over-instead of under-application of N. Regulatory agencies may need this monitoring tool to determine if N fertilization is needed.